

## CLAIMS

What is claimed is:

1. A volumetric three dimensional display device with an interactive pointer, the device comprising:
  - a rotating helical display screen that sweeps out a cylindrical three-dimensional display space;
  - 5 a projector for projecting two-dimensional slices of a three-dimensional data set on said rotating helical display screen so as to generate a three-dimensional volumetric display on said rotating helical display screen; and
  - a laser pointer generating a pulsed laser beam.
2. The display device of Claim 1, wherein said pulsed laser beam is pulsed at a period matching a rotational period of said rotating helical display screen so that said laser beam, if said pointer is maintained in a constant orientation relative to said rotating helical display screen, strikes said rotating helical display screen at a  
5 single spatial point in said cylindrical three-dimensional display space each rotation of said rotating helical display screen.
3. The display device of Claim 1, wherein said laser pointer further comprises a phase control device for controlling a phase of said pulsed laser beam such that said pulsed laser beam strikes said rotating screen at different points in said three-dimensional display space as said phase is changed.
4. The display device of Claim 1, wherein said projector comprises a spatial light modulator.
5. The display device of Claim 1, wherein said laser pointer further comprises an orientation sensor and said laser pointer wireless transmits a signal indicating said pointer's orientation relative to said three-dimensional display space.
6. The display device of Claim 5, wherein said display device further comprises a wireless receiver for receiving said signal indicating said pointer's

orientation relative to said three-dimensional display space, wherein said received signal is provided to a central processor of said display device and said three-  
5 dimensional volumetric display is modified to indicate that section of said three-dimensional display space at which said pulsed laser beam strikes said rotating helical display screen.

7. A volumetric three-dimensional display device comprising:  
a rotating helical display screen that sweeps out a cylindrical three-dimensional display space;  
a first projector for projecting two-dimensional slices of a three-  
5 dimensional data set on said rotating helical screen so as to generate a three-dimensional volumetric display on said screen;  
a second projector for projecting a two-dimensional image that is superimposed on said three-dimensional volumetric display; and  
a slotted plate in a projection path of said second projector, wherein  
10 said slotted plate rotates in synchronization with said rotating helical display screen.

8. The device of Claim 7, wherein a portion of said two-dimensional image passing through at least one slot of said slotted plate is reflected by a mirror onto said rotating helical display screen, and wherein said first projector projecting said two-dimensional slices of said three-dimensional data set through an aperture in  
5 said mirror.

9. The device of Claim 7, wherein a portion of said two-dimensional image passing through at least one slot of said slotted plate is reflected by a beamsplitter onto said rotating helical display screen, and wherein said first projector projecting said two-dimensional slices of said three-dimensional data set through said  
5 beamsplitter.

10. A method of providing a volumetric three dimensional display device with an interactive pointer, the method comprising the steps of:

rotating a helical display screen that sweeps out a cylindrical three-dimensional display space;

- projecting two-dimensional slices of a three-dimensional data set on said rotating helical display screen so as to generate a three-dimensional volumetric display on said rotating helical display screen; and
- 5 generating a pulsed laser beam on a laser pointer.

11. The method of Claim 10, further comprising the step of matching a period in which said laser beam is pulsed with a rotational period of said rotating helical display screen so that said laser beam, if said pointer is maintained in a constant orientation relative to said rotating helical display screen, strikes said rotating
- 5 helical display screen at a single spatial point in said cylindrical three-dimensional display space each rotation of said rotating helical display screen.

12. The method of Claim 10, further comprising the step of controlling a phase of said pulsed laser beam such that said pulsed laser beam strikes said rotating screen at different points in said three-dimensional display space as said phase is changed.

13. The method of Claim 10, further comprising the step of transmitting a signal indicating said pointer's orientation relative to said three-dimensional display space.

14. The method of Claim 13, further comprising the step of receiving said signal indicating said pointer's orientation relative to said three-dimensional display space, wherein said received signal is provided to a central processor of said display device and said three-dimensional volumetric display is modified to indicate that
- 5 section of said three-dimensional display space at which said pulsed laser beam strikes said rotating helical display screen.

15. A method of providing a volumetric three-dimensional display device, comprising the steps of:

rotating a helical display screen that sweeps out a cylindrical three-dimensional display space;

- 5                   projecting two-dimensional slices of a three-dimensional data set on said rotating helical screen so as to generate a three-dimensional volumetric display on said screen;

                  projecting a two-dimensional image that is superimposed on said three-dimensional volumetric display; and

- 10                  rotating a slotted plate in a projection path of said two-dimensional image, wherein said slotted plate rotates in synchronization with said rotating helical display screen.

16.       The method of Claim 15, wherein a portion of said two-dimensional image passing through at least one slot of said slotted plate is reflected by a mirror onto said rotating helical display screen, and wherein said two-dimensional slices of said three-dimensional data set passes through an aperture in said mirror.

17.       The method of Claim 15, wherein a portion of said two-dimensional image passing through at least one slot of said slotted plate is reflected by a beamsplitter onto said rotating helical display screen, and wherein said first projector projecting said two-dimensional slices of said three-dimensional data set through said  
5   beamsplitter.